

## The genus *Pseudostenophylax* Martynov (Trichoptera, Limnephilidae) in Japan

TAKAO NOZAKI

3-16-15, Midorigaoka, Ninomiya-machi, Naka-gun, Kanagawa, 259-0132 Japan. E-mail: takao.nozaki@nifty.com

### Abstract

I revise the Japanese species of the genus *Pseudostenophylax* Martynov (Trichoptera, Limnephilidae), and recognize 8 species including five new species, *P. tohokuensis*, *P. kuharai*, *P. itoae*, *P. tanidai* and *P. befui*, and three previously described species, *P. tochigiensis* Schmid, *P. ondakensis* (Iwata) and *P. dentilus* (Kobayashi). *Pseudostenophylax takaoensis* Schmid is synonymized with *P. ondakenis*. Adults and larvae of all species are described or redescribed except for the larval stage of *P. befui* sp. nov.

**Key words:** new species, new synonym, description, male, female, larva, distribution

### Introduction

The genus *Pseudostenophylax* Martynov 1909 is a genus composed of 96 species distributed in the Oriental, East Palaearctic and Nearctic biogeographic regions (Morse 2013). In Japan, the first species, *P. ondakensis* (Iwata 1928), was described based on larval specimens collected from streams and ponds in Mt. Ondake, Nagano, central Honshu. Tsuda (1945) described an adult male as this species based on specimens collected from a pond, one of the type localities of this species. On the other hand, Schmid (1991) also described a male as this species based on a specimen collected from Togakushi, Nagano, central Honshu, but the illustrations provided by him slightly differ from those by Tsuda (1945) in the shape of abdominal segment VIII and intermediate appendages of segment X. The male genitalia illustrated by Schmid (1991) are rather similar to those of the second Japanese species, *P. dentilus* (Kobayashi 1973). Furthermore, Schmid (1991) described the third and fourth Japanese species, *P. takaoensis* Schmid 1991 and *P. tochigiensis* Schmid 1991, from central Honshu; however, the illustrations of the male of *P. takaoensis* are similar to those of *P. ondakensis* provided by Tsuda (1945).

To solve these taxonomic problems, I examined extensive material of *Pseudostenophylax* including the type specimens of *P. ondakensis*, *P. dentilus* and *P. takaoensis*, and recognized 8 species in the Japanese fauna. In this paper, I describe or redescribe all Japanese species.

### Material and methods

Male and female genitalia and some larval characters were figured after being cleared in a 10% solution of KOH. Larval characters described are based on final instar larvae. Larvae were associated with their adult males by rearing for *P. tochigiensis*, *P. ondakensis*, *P. dentilus*, *P. tohokuensis* sp. nov. and *P. kuharai* sp. nov., but larval specimens of *P. itoae* sp. nov. and *P. tanidai* sp. nov. collected from the same area where males of each species were collected were used for the descriptions of larvae of those two species. Morphological terms mainly follow Schmid (1998) for the adult and Wiggins (1996) for the larva. Depositories of the specimens are abbreviated as follows: Natural History Museum and Institute, Chiba (CBM); N. Kawase, Minakuchi Kodomo-no-mori Nature Museum, Koka (NK); National Museum of Natural History, Smithsonian Institution, Washington DC (NMNH); the Kyoto University Museum, Kyoto (KUM); K. Tanida, Osaka Prefecture University, Sakai (KT); T. Nozaki, Ninomiya, Kanagawa (TN).

## Species descriptions

### *Pseudostenophylax tochigiensis* Schmid 1991

(Figs. 1, 2, 10)

*Pseudostenophylax tochigiensis* Schmid 1991, 24, pl. 2, male.

*Pseudostenophylax ondakensis* (Iwata 1928): Tanida 1985, 197, larva, case, misidentification.

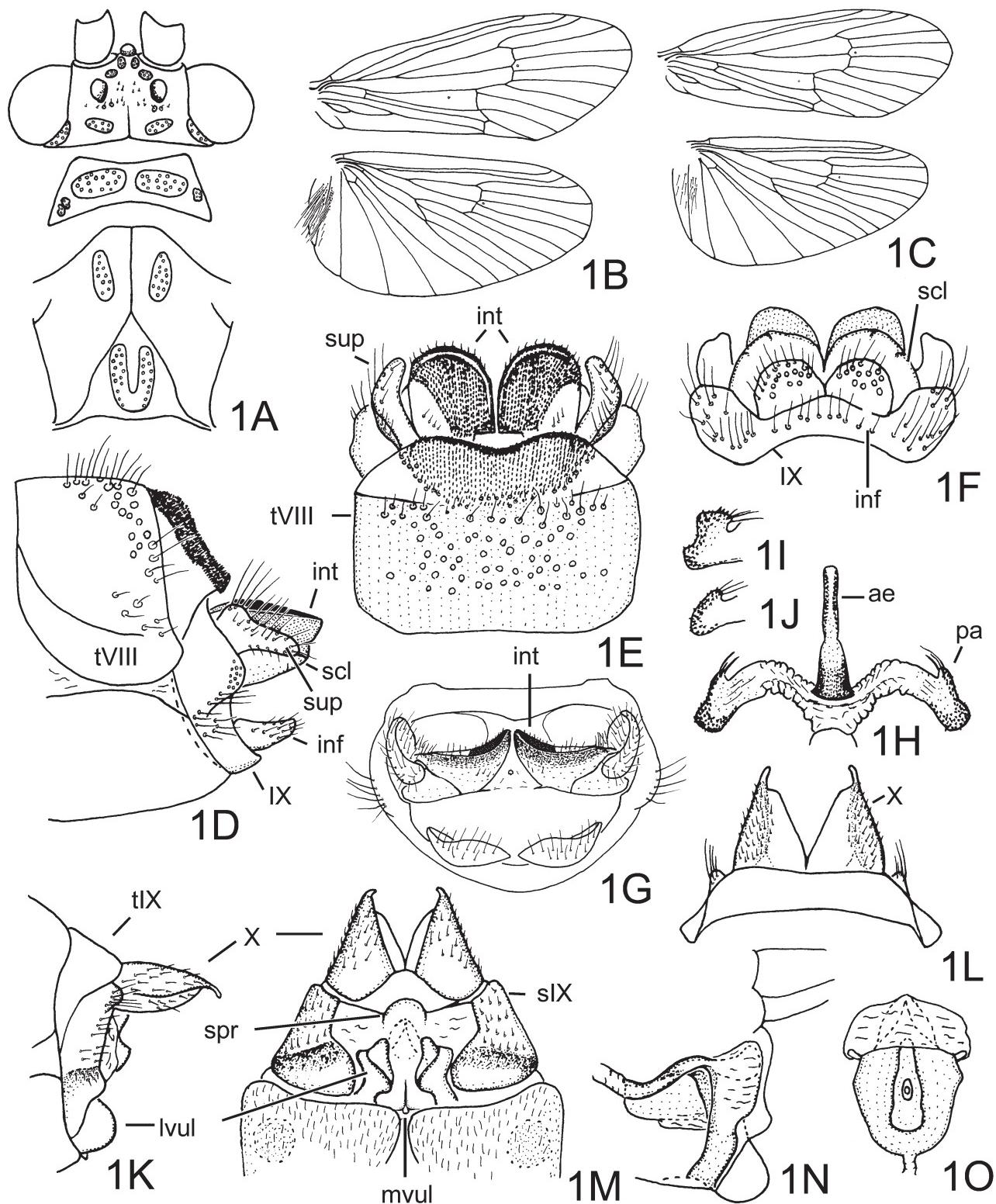
**Adult.** Body, antennae dark brown. Head shorter than wide; with large ocelli, about 1/4 of eyes in length; with pair of anteromesal and anterior setal warts, oval, anterior warts smaller than ocelli; pair of posterior setal warts oval, slightly larger than ocelli. Pronotum with pair of setal warts dorsally, large oval; laterally with pair of small setal warts, occasionally divided into 2 warts. Mesoscutal setal warts elongate oval; mesoscutellar setal warts long, usually fused posteriorly. Forewings dark brown with numerous pale spots, reticulated; each 16–22 mm long in male, 17–19 mm in female. Hind wings pale brown, wider than forewings, with brush of white hair-like bristles on jugal region in male, hair-like setae short and sparse in female. Venation as in Figures 1B, 1C. Tibial spurs 1-3-4.

**Male genitalia.** Tergum VIII higher than long in lateral aspect; posterodorsal sclerotized area densely covered by short spine-like setae, crescent-shaped in dorsal aspect, slightly concave posteriorly. Segment IX in lateral aspect short dorsally, swelling posterolaterally at midway. Superior appendages ear-like in lateral aspect, slightly concave mesally. Intermediate appendages large, long semicircular; upper side deeply concave, covered with minute denticles except for basolateral part. Lateral sclerites of segment X largely fused into intermediate appendages. Inferior appendages one segmented, triangular in lateral aspect, round or square or trapezoidal in ventral aspect, often slightly protruding midway in ventral aspect. Aedeagus (= *Phallicata* auct.) sclerotized, slender, bottle-shaped with long neck in dorsal aspect; basal part strongly sclerotized, black basally. Parameres large, membranous basally, sclerotized apically; sclerotized part hook-shaped, denticulate apically, mesal apex with several long spines, often variable in shape even in same locality.

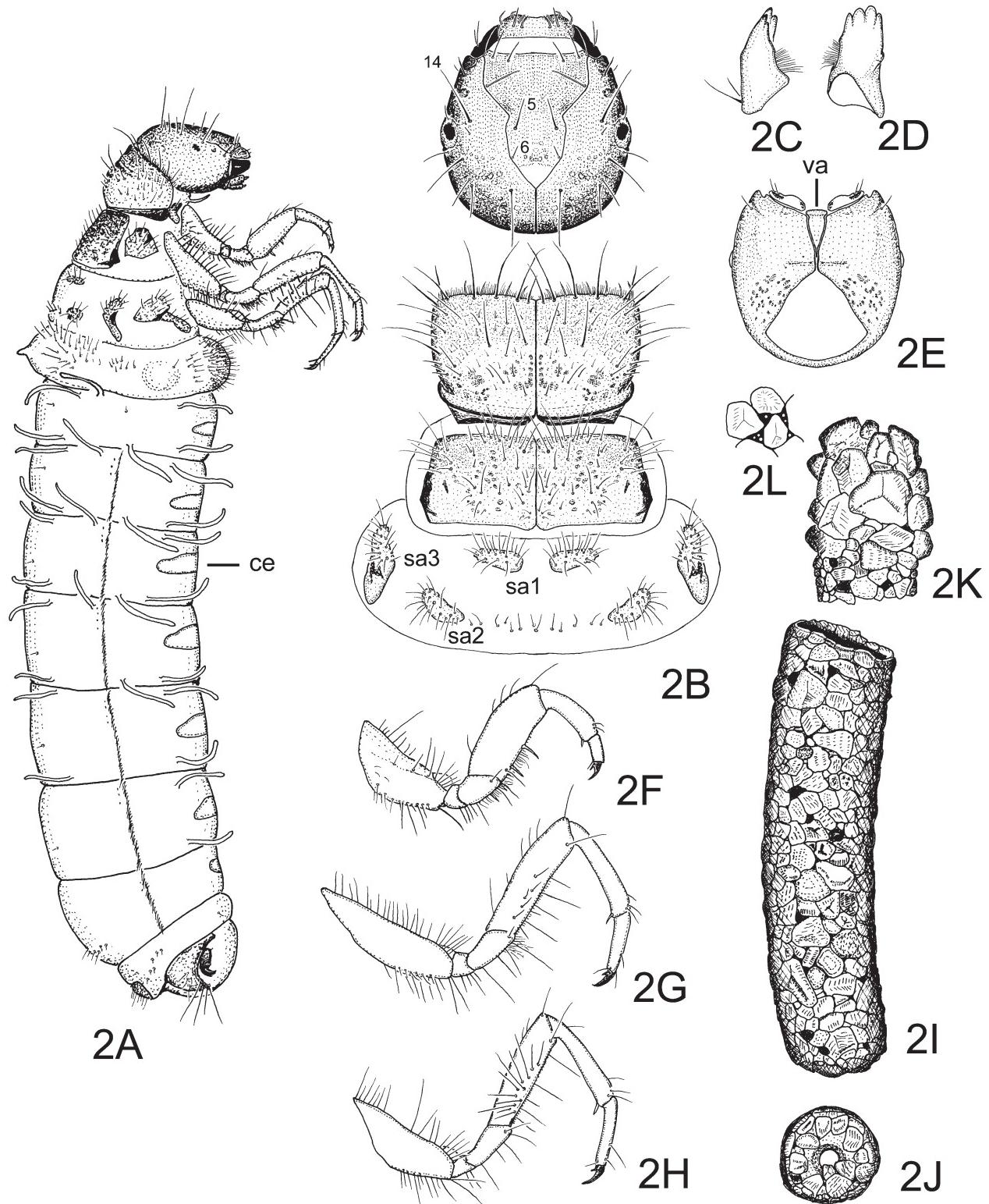
**Female genitalia.** Tergum IX triangular in lateral aspect. Sternum IX long rectangular in lateral aspect, slightly protruding posterolaterally, concave ventrally. Segment X developed into two large lobes, each long bell-shaped in dorsal aspect, mesal line angled near apex; with slender finger-like process apically, slightly curved mesoventrad, unpigmented; 1.2–1.6 times as long as basal width in dorsal aspect. Supragenital plate vestigial, weakly sclerotized. Vulval scale consisting of small median lobe and pair of large lateral lobes; median lobe slender, directed posteroventrad; lateral lobes strongly sclerotized, projecting posterad, ear-like in ventral aspect, with subapicomesal part concave; semicircular in lateral aspect. Vaginal sclerite simple, situated posteriorly, reverse L-shaped in lateral aspect, bathtub-like in dorsal aspect.

**Final instar larva.** Length up to 20 mm. Head round in dorsal aspect; mostly reddish or dark brown, but posterior corner of frontoclypeal apotome pale brown; primary setae 5 each about 1–1.5 times as long as distance between bases of setae 5; setae 6 transparent, short, each 1/4–1/2 length of seta 5; setae 14 longest; ventral setae 18 minute. Ventral apotome vase-shaped, elongated caudally. Labrum yellowish brown; with primary setae 2–6 on dorsum; anteroventral setae 1 shortest. Mandibles black, but often paler apically; right and left ones almost symmetrical, triangular in dorsal aspect; four apical teeth present, although often shortened or made indistinct by abrasion. Prosternal horn long. Pronotal sclerites dark brown, but slightly paler in posterior half; with many pigmented or transparent setae; anterior edge with transparent hair-like setae. Mesonotal sclerites mostly dark brown. Metanotal sclerites dark brown, with transverse band of setae between *sa2* sclerites. Hind femora each bearing 5–7 setae along ventral edge, with 10–16 setae laterally. Abdominal segment I with more than 100 setae dorsally and ventrally. Abdominal gills single, present on following segments: dorsal gills on abdominal segments II to V (anterior and posterior), on VI (anterior and often posterior) and usually on VII (anterior); lateral gills on II to IV (anterior and posterior), on V (anterior and often posterior) and often on VI (posterior); ventral gills on II to VII (anterior and posterior) and often on VIII (anterior). Lateral fringe and forked lamellae present on abdominal segments III to VIII. Ventral chloride epithelia present on abdominal segments II to VIII. Anal claws each with one accessory hook.

**Case.** Case of final instar larva up to 20 mm long, constructed of sand grains, often mostly phlogopite micas; cylindrical; posterior end closed by silk and sand grains with central hole. In pupal case, both ends covered by coarser sand grains than those of larval case, with perforations in gaps of sand.



**FIGURE 1.** Adults of *Pseudostenophylax tochigiensis*. A, head and pro- and mesonota, dorsal. B, male right wings, dorsal. C, female right wings, dorsal. D–J, male genitalia: D, left lateral; E, dorsal; F, ventral; G, caudal; H, phallus, dorsal; I and J, apex of right paramere, variations, dorsal. K–O, female genitalia: K, left lateral; L, dorsal; M, ventral; N, vaginal sclerite, left lateral; O, vaginal sclerite, dorsal. Abbreviations: IX = segment IX; X = segment X; ae = aedeagus; inf = inferior appendage (paired); int = intermediate appendage (paired); mvul = median vulval lobe; pa = paramere (paired); sIX = sternum IX; scl = lateral sclerite of segment X; lvul = right lateral vulval lobe (paired); spr = supragenital plate; sup = superior appendage (paired); tVIII = tergum VIII; tIX = tergum IX.



**FIGURE 2.** Larva, larval case and pupal case of *Pseudostenophylax tochigiensis*. A–H, larva: A, right lateral; B, head, pro-, meso- and metanota, dorsal, primary setae 5, 6 and 14 numbered; C, left mandible, dorsal; D, left mandible, mesal; E, head, ventral; F, right foreleg, lateral/caudal; G, right middle leg, lateral/caudal; H, right hind leg, lateral/caudal. I–J, larval case: I, right lateral; J, posterior end, caudal; K–L, anterior closure of pupal case: K, right lateral; L, , anterior. Abbreviations: ce = chloride epithelia; va = ventral apotome.

**Specimens examined.** **Honshu. Miyagi:** Yoko-kawa, 850 m a.s.l., near Funagata-yama, Aoba-ku, Sendai-shi, 5.x.2001, T. Nozaki, 20 larvae (TN); ibid., larvae collected on 5.x.2001, adults emerged on 21.iv–26.v.2002 by T. Nozaki, 5 males, 5 female (TN); **Tochigi:** Nagasawa, Yunishi-gawa, Nikko-shi, 15.iv.1999, T. Kagaya, 1 male (TN); near Furumine-jinja, 700 m a.s.l., Kusagyu, Kanuma-shi, 25.ix.2002, N. Kubota, 6 larvae (2 larvae, NMNH; others, TN); **Saitama:** Wasabi-zawa, 1,200 m a.s.l., Otaki, Chichibu-shi, larvae collected on 24.ix.1999, adults emerged on 13.iii–1.iv.2000 by T. Nozaki, 4 males, 2 females (1 male: CBM-146877; 1 male, 1 female: NMNH; others: TN); ibid., 24.ix.1999, T. Nozaki, 2 larvae (TN); **Kanagawa:** headwaters of Haragoya-sawa, 1,280 m a.s.l., Tsukui-cho, Sagamihara-shi, larvae collected on 10.v.1995, adults emerged on 28.vii–21.viii.1995 by T. Nozaki, 2 males, 1 female (TN); ibid., 10.v.1995, T. Nozaki, 2 males, 1 female (TN); **Niigata:** Otashinden, Tsunan-cho, 16.v.1993, H. Moriya, 1 male (TN); Kiyotsu-kyo, Mitsumata, Yuzawa-machi, 11–14.v.1999, N. Kawase, 2 males (NK); **Yamanashi:** Sakubadaira, Ichinose, Kamiogiwara, Koshu-shi, 15.vi.1989 (light), T. Nozaki, 2 males (TN); ibid., 1.viii.1989, T. Kagaya & T. Nozaki, 1 male (TN); ibid., 23.v.1990 (light), T. Nozaki, 7 males, (TN); ibid., 13.vi.1990, T. Nozaki & T. Kagaya, 1 male (TN); ibid., 19.vii.1990, T. Nozaki, 1 male, (TN); ibid., 22.v.1999 (light), T. Hattori, 15 males, 1 female (TN); Hi-kawa, 1,450 m a.s.l., Koshu-shi, 26.iv.1986, T. Nozaki, 4 larvae (TN); Fudo-gawa, Koshu-shi, 4.v.1984, S. Ishiwata, 3 males (TN); **Nagano:** Sanbon-daki, Norikura-kogen, Azumi, Matsumoto-shi, 13.ix.2008, T. Nozaki, 2 larvae (TN); Kiso-gawa, Ina-gawa main, 1,800 m a.s.l., 29.ix.1990, Y. Takemon, 1 male, 4 larvae (KT); Ogi-onsen, 3.v.1990, H. Nishimoto, 1 male, 1 female (TN); Oguro-gawa, 900 m a.s.l., Ina, Ina-shi, 21.vi.1999, T. Tsuruishi, 1 male (TN); ibid., 28.viii.1999, T. Tsuruishi, 1 larva (TN); Oizumi-gawa, 1,020 m a.s.l., Minami-minowa-mura, 5.v.1998, T. Tsuruishi, 4 males (TN); Minoto, Yanagawa, Chino-shi, 10.iv.2001, T. Tsuruishi, 5 larvae (TN); Nakano-sawa, Sugadaira, Ueda-shi, 25.ix.1983, T. Nozaki, 1 larva (TN); Shibusawa, Sugadaira, Ueda-shi, 26.ix.1983, K. Tanida, 15 larvae (KT); Mt. Ontake, Tsumeta-gawa, Kaidakogen-nishino, Kiso-machi, 4.v.1986, S. Ishiwata, 2 larvae (TN); Gonbei-toge, Narai, Shiojiri-shi, 3.v.1986, S. Ishiwata, 1 larva (TN); Ibara-zawa, Saku, Koumi-cho, 30.v.1997, T. Hattori et al., 1 larva (TN); **Gifu:** Kagamidaira, 2,380 m a.s.l., Kamitakara-cho, Takayama-shi, 28.vii.1998, K. Eda, 1 male (TN); Hikagedaira, Takayama-shi, 20.ix.1998, H. Nishimoto, 1 male (TN); **Shizuoka:** Higashizawa-deai, Abe-kawa, 900 m a.s.l., Umegashima, Aoi-ku, Shizuoka-shi, 2.vi.1995, T. Hattori, 1 male (TN); Abe-toge, a head of Sakasa-gawa, 1,400 m a.s.l., Aoi-ku, Shizuoka-shi, 3.v.1999, T. Hattori & T. Ito, 24 larvae (TN); **Nara:** Odaigahara, Kami-kitayama-mura, 6.ix.1984, H. Nishimoto, 1 female (TN).

**Distribution.** Japan (Honshu).

**Biology.** Larvae inhabit leaf accumulations of cool mountain streams and spring flows and mainly feed on dead plant material. Adult males are often collected by light traps in high mountain areas from early summer through autumn, but females of this species group fly to lights very rarely, perhaps because their fore- and hind wings are shorter than those of the males.

**Japanese name.** Tochigi-miyama-tobikera.

**Remarks.** This species belongs to the *P. ondakensis* Species Group (Schmid 1991). The male of this species is unique among those of the *P. ondakensis* Group in having large, egg-shaped intermediate appendages of segment X. In the female, the genitalia of all Japanese species are similar to each other, but the female of this species can be distinguished from those of other species by the large bell-shaped segment X. The larva is also distinguishable from those of other members of the *P. ondakensis* Group by having both ventral chloride epithelium on abdominal segment VIII and a pale marking on the posterior corner of the frontoclypeal apotome.

Tanida (1985) illustrated a larva as *P. ondakensis*. His larva has a pale posterior corner of the frontoclypeal apotome; however, larvae of *P. ondakensis* have an entirely dark head (Iwata 1928, 1930). I examined specimens used by him, and confirmed that these larvae are in accord with those of *P. tochigiensis* described above.

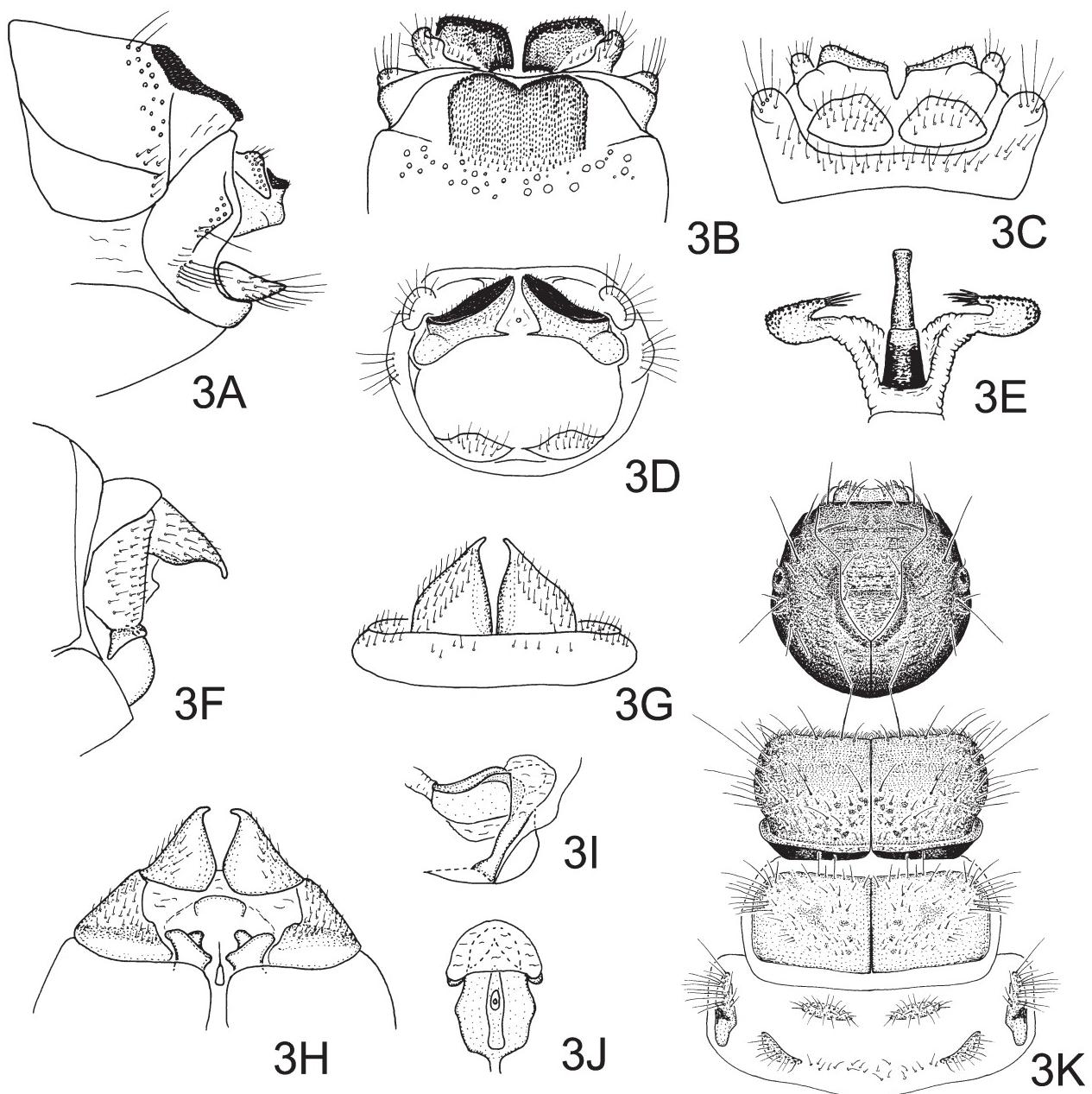
### *Pseudostenophylax ondakensis* (Iwata 1928)

(Figs. 3, 10)

*Stenophylax ondakensis* Iwata 1928, 120, 126, 130, larva, case; Iwata 1930, 1022–1027, larva, case; Tsuda 1945, 12–13, male; Tsuda 1959, 148, larva, case.

*Pseudostenophylax ondakensis*: Schmid 1955, 111, changed combination.

*Pseudostenophylax takaoensis* Schmid 1991, 23–24, pl. 2, male. **Syn. nov.**



**FIGURE 3.** Adults and larva of *Pseudostenophylax ondakensis*. A–E, male genitalia: A, left lateral; B, dorsal; C, ventral; D, caudal; E, phallus, dorsal. F–J, female genitalia: F, left lateral; G, dorsal; H, ventral; I, vaginal sclerite, left lateral; J, vaginal sclerite, dorsal. K, larval head, pro-, meso- and metanota, dorsal.

**Adult.** General appearance similar to *P. tochigiensis*. Forewings each 13–19 mm long in male, 13–16 mm in female.

**Male genitalia.** Tergum VIII little higher than long in lateral aspect; posterodorsal sclerotized area densely covered by short spine-like setae, rounded or square, with apical concavity in dorsal aspect. Segment IX in lateral aspect short dorsally, swelling posterolaterally at midway. Superior appendages ear-like in lateral aspect, slightly concave mesally. Intermediate appendages hatchet-shaped in dorsal aspect; directed inward, upper side slightly concave laterally, covered with minute denticles except for basolateral part. Lateral sclerites of segment X largely fused into intermediate appendages. Inferior appendages each one-segmented, triangular in lateral aspect, trapezoidal in ventral aspect. Aedeagus very similar to that of *P. tochigiensis*, bottle-shaped with long neck in dorsal aspect; basal part strongly sclerotized, black basally. Parameres large, membranous basally, sclerotized apically; sclerotized part hook-shaped, denticulate apically, mesal apex with several long spines.

**Female genitalia.** Very similar to those of *P. tochigiensis*, but lobes of segment X shorter than those of the latter, each lobe about 1.2 times as long as basal width in dorsal aspect, mesal line smoothly sinuous, with longitudinal dorsal ridge about 1/4 from mesal margin. Vaginal sclerite similar to that of *P. tochigiensis*, but concavity of posterodorsal corner deeper in lateral aspect.

**Final instar larva.** Length up to 20 mm. Head mostly reddish brown to black, round in dorsal aspect; depressed along posterior half of frontoclypeal suture, posterior corner of frontoclypeal apotome (behind primary setae 6) also depressed; primary setae 5 each about 0.6–1.0 times as long as distance between bases of setae 5; setae 6 transparent, short, each about 1/2 length of setae 5; setae 14 longest; ventral setae 18 minute. Ventral apotome vase-shaped, elongated caudally. Labrum dark brown, similar to that of *P. tochigiensis*. Mandibles black, similar to those of *P. tochigiensis*. Prosternal horn long. Pronotal sclerites dark brown, often slightly paler in posterior half; with long pigmented or short transparent setae broadly on setal areas from *sa2* to *sa3*, but without setae in anteromesal area except along anterior margin; long pigmented setae and short transparent setae arising alternately along anterior margin, anterior edge with transparent hair-like setae. Mesonotal sclerites dark brown. Metanotal sclerites dark brown, with transverse band of setae between *sa2* sclerites. Hind femora each bearing 4 to 6 setae along ventral edge, with 9–14 setae laterally. Abdominal segment I with about 100 setae dorsally, with more than 100 setae ventrally. Abdominal gills single, present on following segments: dorsal gills on abdominal segments II to V (anterior and posterior), on VI (anterior and often posterior) and usually on VII (anterior); lateral gills on II to IV (anterior and posterior), often on V (anterior and posterior) and VI (posterior); ventral gills on II to VII (anterior and posterior) and rarely on VIII (anterior). Lateral fringe and forked lamellae present on abdominal segments III to VIII segments. Ventral chloride epithelia present on abdominal segments II to VII, segment VIII rarely with small one (less than 1/4 as large as of those on other segments). Anal claws each with one accessory hook.

**Case.** Both larval and pupal cases similar to those of *P. tochigiensis*.

**Specimens examined.** Lectotype of *Stenophylax ondakensis* Iwata (selected here): A larva (in alcohol), near Ichinomata-goya, Mt. Ondake Nana-gome, Shinshu, 23.vii.1927, Iwata (KUM-In 080: stored separately in small vial with label “Lectotype”); 6 larval paralectotypes of *S. ondakensis*: Same data as lectotype (KUM-In 080: stored separately in another small vial with a label “Paralectotypes”). Holotype male of *P. takaoensis* Schmid (pinned): Takao-Jinba, 21–30.iv.1959, K. Fujimoto (NMNH, Type no. 104922); paratype male of *P. takaoensis* Schmid (pinned): same data as holotype (NMNH).

**Other specimens. Honshu.** Saitama: Kudono-sawa, 750 m a.s.l., Otaki, Chichibu-shi, 7–28.viii.1998, T. Kagaya et al., 1 male (TN); Niigata: Wasabi-zawa, 1,115 m a.s.l., Udo-gawa, Otokoro, Itoigawa-shi, 14.viii.1998 (light), T. Hattori, 1 male (TN); Toyama: Tateyama, Mimatsu, 25.vii.1973, C. Tanaka, 3 males (KT); Ishikawa: Murodo, Haku-san, 6.viii.1980 (light), Tomizawa, 3 males (KT); Nanryu, Haku-san, 8.viii.1980, Tomizawa, 4 males, 2 females (KT); Shiramine, Hakusan-shi, 20.viii.2001, H. Kawase, 1 male (TN); Fukui: Ohara-toge, Katsuyama-shi, 16.vi.2001, H. Kawase, 1 male (TN); Mt. Akausagi, Katsuyama-shi, 29.vii.1987, I. Togashi, 1 male (KT); Akausagi-yama, Katsuyama-shi, 1.xi.2006, T. Ito, 1 larva (TN); Yamanashi: Ichinose, Kamiogiwara, Koshu-shi, 26.ix.1989 (light), T. Nozaki & T. Kagaya, 2 males (TN); Sakubadaira, 1,300 m a.s.l., Ichinose, Kamiogiwara, Koshu-shi, 22.v.1999 (light), T. Hattori, 1 male (TN); Kita-zawa, Ichinose-gawa, Koshu-shi, 1.v.1991, T. Nozaki, 1 larva (TN); Hi-kawa, Yamato, Koshu-shi, 3.viii.1999 (light), N. Kawase, 1 male (TN); Nagano: Kurosawa San-gome, 1,060 m a.s.l., Mitake, Kiso-machi, 4.viii.1998, T. Nozaki, 3 larvae (TN); ibid., collected on 4.viii.1998, fixed 14.ix.1998 by T. Nozaki, 1 larva (TN); ibid., collected on 4.viii.1998, adults emerged on 25.v–4.vii.1999 by T. Nozaki, 3 males, 3 females (1 male CBM-146878; 1 male, 1 female NMNH; others TN); ibid., 18.ix.1998, T. Nozaki, 4 larvae (2 larvae NMNH; others TN); ibid., larvae collected on 18.ix.1998, adults emerged on 22.vi–28.vii.1999 by T. Nozaki, 2 male, 3 female (TN); Kiso-gawa, Ina-gawa main, 1,800 m a.s.l., 29.ix.1990, Y. Takemon, 1 male (TN); Shirabi-daira, Miyata-mura, 17.vii.2003, T. Befu, 1 male (TN); Oguro-gawa, 1,230 m a.s.l., Ina-shi, 18.ix.1997 (light), T. Tsuruishi, 1 male (TN); Oguro-gawa, 900 m a.s.l., Ina-shi, 11.ix.1999 (light), T. Tsuruishi, 1 male (TN); Oguro-hinata, Ina-shi, 27.viii.1999, N. Kubota, 2 males (TN); Sansho-zawa, Kurosawa-gawa, Misato, Azumino-shi, 16.vi.1999, N. Kubota, 1 male (TN); Shimashimadani, Azumi, Mastumoto-shi, 29.ix.1990 (light), N. Kuhara, 2 males (TN); Arata-zawa, Koonozawa, 2,100 m a.s.l., Mt. Norikura, Azumi, Matsumoto-shi, 17.vii.1999, N. Kubota, 3 larvae (TN); Kamanashi-gawa, 1,300 m a.s.l., Fujimi-machi, 29.v.1993 (light), T. Hattori, 1 male (TN); Kurosawa, Yokokawa-gawa, Tatsuno-machi, 17.viii.1996 (light), T. Hattori, 1 male (TN); small stream, Noga-ike, 2,700 m a.s.l., Miyata-mura, 9.viii.1998, N. Nishio, 2 larvae (TN); Gifu: Hikage-daira, Takayama-shi, 20.ix.1998, H. Nishimoto, 6 males (TN); Shizuoka: Chausu-goya, 2,400 m

a.s.l., Mt. Chausu, Aoi-ku, Shizuoka-shi, 27.vii.1986, T. Nozaki, 2 males, 1 female (TN); Abe-toge, Umegashima, Aoi-ku, Shizuoka-shi, 22.viii.1993, T. Hattori, 1 male (TN); ibid., 5.v.1997, T. Hattori, 1 male (TN); ibid., 23.viii.1997 (light), T. Hattori, 8 males (TN); ibid., 10.vii.1999, T. Hattori, 1 male (TN); Higashizawa-deai, 900 m a.s.l., Abe-kawa, Umegashima, Aoi-ku, Shizuoka-shi, 2.vi.1995, T. Hattori, 2 males (TN); Nishi-hikage-zawa, 900 m a.s.l., Umegashima, Aoi-ku, Shizuoka-shi, 14.x.1995 (light), T. Hattori, 4 males (TN); ibid., 3.v.1999 (light), T. Hattori & T. Ito, 2 males (TN); Ikawa-toge, 1,600 m a.s.l., Umegashima, Aoi-ku, Shizuoka-shi, 29.iv.1998, T. Hattori, 1 male (TN); ibid., 25.vii.1998, T. Hattori, 1 male (TN); **Nara**: Odaigahara, Kami-kitayama-mura, 6.ix.1984, H. Nishimoto, 1 male (TN).

**Distribution.** Japan (Honshu).

**Biology.** Similar to that of *P. tochigiensis*, but the larval habitats are smaller than those of the latter. Larvae have been collected from small ponds and flows in high mountain areas, and seepages beside mountain streams.

**Japanese name.** Ondake-tobikera.

**Remarks.** Iwata (1928) described this species based on larvae collected from 4 sites on Mt. Ondake. In the collection of Dr. Iwata deposited in the Kyoto University Museum, I found many larvae belonging to the genus *Pseudostenophylax* in a bottle labeled "In 080, *Stenophylax ondakensis* Iwata". The larvae are preserved separately in three small vials, which bear labels written in Japanese as "near Ichinomata-goya, Mt. Ondake Nana-gome, Shinshu, 23.VII/1927, Iwata", "Ondake, Yon'no-ike, 8.4, Yokouchi" or "Ondake-noboriguchi, San-gome, 23.VII", respectively. These locality names agree with three of four sites appearing in Iwata's paper, but the dates on the latter two labels are different from those recorded by Iwata (1928, page 120). At least the larvae bearing the first label are considered to be some of the syntypes. All larvae (more than 25 individuals) in this vial are not in good condition, being dried up, but 7 final instar larvae retain several characters on their heads and bodies. The heads of these larvae are depressed along the posterior half of the frontoclypeal suture, and their bodies have ventral chloride epithelia on abdominal segments II to VII. I designated one of them as the lectotype and the other 6 larvae as paralectotypes. Some larvae in the other 2 vials also have the same characters, although these characters could not be observed in most larvae, especially early instars. In 1998, I collected larvae identical to Iwata's larvae from Kurosawa San-gome, Mitake, Kiso-machi, Nagano, one of the four sites mentioned by Iwata (1928), and some of them were reared in a laboratory. The males that emerged from them agree with those illustrated by Tsuda (1945). Illustrations of both adults and larvae provided here are based on these materials.

I also confirmed that *P. takaoensis* is the same species as this species based on the examination of the holotype male of *P. takaoensis*.

### *Pseudostenophylax dentilus* (Kobayashi 1973)

(Figs. 4, 10)

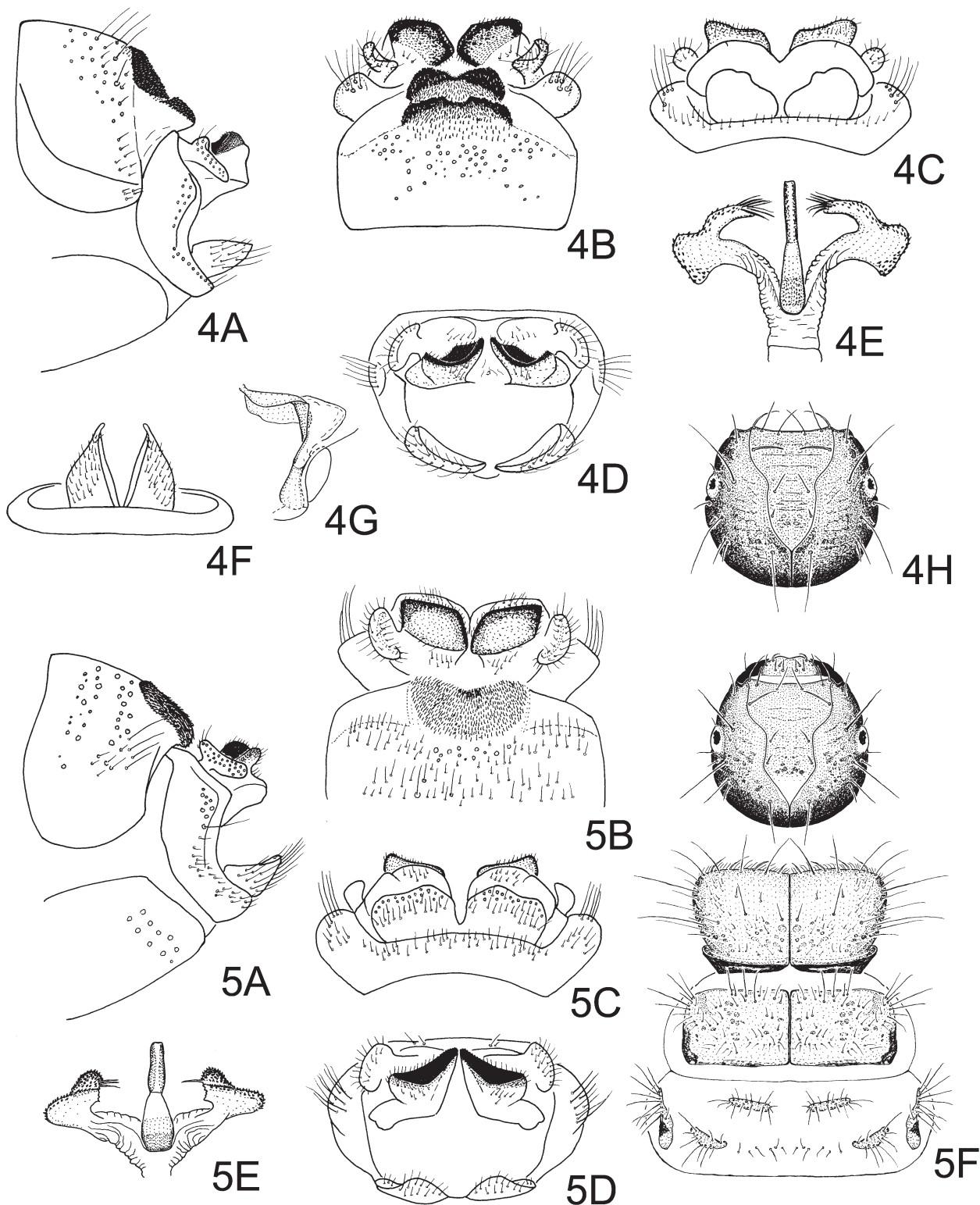
*Stenophylax dentilus* Kobayashi 1973, 38–39, pl.10, male, female.

*Pseudostenophylax dentilus*: Nozaki et al. 2000, 205, changed combination.

*Pseudostenophylax ondakensis*: Schmid 1991, 23–24, pl. 2, male, misidentification.

**Adult.** General appearance similar to *P. tochigiensis*. Forewings each 15–18 mm long in male, 14–16 mm in female.

**Male genitalia.** Tergum VIII higher than long in lateral aspect; posterodorsal sclerotized area densely covered by short spine-like setae, stepwise in lateral and dorsal aspect, with apical concavity in dorsal aspect. Segment IX in lateral aspect short dorsally, swelling posterolaterally at midheight. Superior appendages ear-like in lateral aspect, slightly concave mesally. Intermediate appendages similar to those of *P. ondakensis*, but approximately as long as wide; hatchet-shaped in dorsal aspect; directed inward, upper side slightly concave, covered with minute denticles except for basolateral part. Lateral sclerites of segment X largely fused with intermediate appendages. Inferior appendages one-segmented, triangular in lateral aspect, round in ventral aspect, rugged apically. Aedeagus bottle-shaped in dorsal aspect, with long neck and bulbous base; mostly sclerotized but weak at base. Parameres large, membranous basally, sclerotized apically; sclerotized part hammer-shaped, denticulate apically, mesal slender part with several long spines apically.



**FIGURES 4–5.** 4, Adults and larva of *Pseudostenophylax dentilus*. A–E, male genitalia: A, left lateral; B, dorsal; C, ventral; D, caudal; E, phallus, dorsal. F–G, female genitalia: F, dorsal; G, vaginal sclerite, left lateral. H, larval head, dorsal. 5, Male and larva of *P. tohokuensis*. A–E, male genitalia: A, left lateral; B, dorsal; C, ventral; D, caudal; E, phallus, dorsal. F, larval head, pro-, meso- and metanota, dorsal.

**Female genitalia.** Shape of segment X similar to that of *P. ondakensis*; but each lobe slender, 1.5 times as long as basal width in dorsal aspect, with dorsal ridge near mesal margin in dorsal aspect. Vaginal sclerite similar to that of *P. tochigiensis*, concavity of dorsoposterior corner shallow in lateral aspect.

**Final instar larva.** Larva up to 18 mm. Head mostly reddish brown, round in dorsal aspect; primary setae 5 each about 0.7–1.0 times as long as distance between bases of setae 5; setae 6 transparent, short, each about 1/2 length of seta 5; setae 14 longest; ventral setae 18 minute. Ventral apotome, labrum and mandibles similar to those of *P. ondakensis*. Prosternal horn long. Pronotal sclerites dark brown; with long pigmented or short transparent setae broadly on setal areas from *sa2* to *sa3*, but without setae in anteromesal area except along anterior margin; long pigmented and short transparent setae arising alternately along anterior margin, anterior edge with transparent hair-like setae. Mesonotal sclerite yellowish to dark brown. Metanotal sclerites yellowish to dark brown, with transverse band of setae between *sa2* sclerites. Hind femora each with 5 to 7 setae along ventral edge, with 9 to 16 setae laterally. Abdominal segment I with 80 to 100 setae dorsally, with more than 100 setae ventrally. Abdominal gills single, present on following segments: dorsal gills on II to V (anterior and posterior), on VI (anterior and often posterior) and usually on VII (anterior); lateral gills on II to IV (anterior and posterior), often on V (anterior and posterior) and VI (posterior); ventral gills on II to VII (anterior and posterior). Lateral fringe and forked lamellae present on abdominal segments III to VIII. Ventral chloride epithelia present on abdominal segments II to VII. Anal claws each with one accessory hook.

**Case.** Both larval and pupal cases similar to those of *P. tochigiensis*.

**Specimens examined.** Shenjogahara, Chokai National Park, Yamagata, 11 males, 7 females (in alcohol, including the type series materials but not separated) (CBM, M-2495).

**Other specimens.** **Miyagi:** small tributary of Yoko-kawa, 850 m a.s.l., near Funagata-yama, Aoba-ku, Sendai-shi, 5.x.2005, T. Nozaki, 4 larvae (TN); ibid., larvae collected on 5.x.2005, adults emerged on 29.iv–6.vi.2002 by T. Nozaki, 2 males, 2 female (TN); **Yamagata:** Shizu, Nishikawa-machi, 19.ix.2004, H. Nishimoto, 18 larvae (2 larvae NMNH; others TN); ibid., 13.ix.2008, N. Kuhara, 1 larva (TN); Gassan springs, 775 m a.s.l., Shiga, Nishikawa-machi, 24.ix.2004, H. Moriya, 2 larvae (TN); ibid., larvae collected on 24.ix.2004 by H. Moriya, adults emerged on 27.iv–2.vi.2005 by T. Nozaki, 3 males (1 male NMNH; others TN); Tateki, Asahi-machi, 12.ix.2008, N. Kuhara, 1 male (TN); Yanagisawa-goya, Kurobushi-kogen, Higashine-shi, 12.ix.2008, N. Kuhara, 2 males (TN); **Fukushima:** Kowashimizu, Takamori-atami, Koriyama-shi, 16.v.1988, S. Ishiwata, 1 larva (TN); **Gunma:** Yamanohana, Oze, 26.ix.1995 (light), K. Tanida & T. Nozaki, 1 male (TN); stream flowing into Lake Suga-numa, Katashina-mura, 27.v.1986, S. Ishiwata, 7 larvae (TN); **Niigata:** Nabekura-zawa, tributary of Tainai-gawa, 330 m a.s.l., Tainai-shi, 19.ix.2004 (light), N. Kuhara, 2 males (TN); Aburuma-gawa, Irihirose, Uonuma-shi, 10.x.1993, S. Ishiwata, 1 male (TN); Shiori-toge, 1,000 m a.s.l., Yunotani, Uonuma-shi, 2.vii.1999, T. Hattori, 1 male (CBM-146879); Fukamichi-zawa, Hirogami, Uonuma-shi, 7.ix.2000, N. Kawase, 1 larva (TN); Shimizu, Shiozawa, Minamionuma-shi, 5.ix.2001 (light), N. Kawase, 1 male (TN); Kiyotsu-kyo, Kaikake, Yuzawa-machi, 11–14.v.1999, N. Kawase, 4 larvae (NK); **Nagano:** Togakushi, 5.viii.1957, K. Fujimoto, 1 male (NMNH, Nakahara collection).

**Distribution.** Japan (Honshu).

**Biology.** Similar to that of *P. ondakensis*.

**Japanese name.** Yamagata-miyama-tobikera.

**Remarks.** Kobayashi (1973) said that he designated a male collected from Shenjogahara, Chokai National Park, Yamagata Prefecture on May 26, 1969, as the holotype (M. 2495a) and five males collected from the same locality on the same day as paratypes (M. 2495b–f). He also determined 4 males (M. 2495g–j) and 8 females (M. 2495k–r) collected from Mt. Azuma, Yamagata Prefecture on May 26, 1969 [!1969] as this species in the same paper. In the Kobayashi collection now deposited in CBM, I found 11 males and 7 females in a vial labeled “Limnephili 2495♂♀”. Although the holotype or paratypes were not separated in the vial, all males agreed with the description by Kobayashi (1973). I also examined the male determined as *P. ondakensis* by Schmid (1991), and confirmed it to be the same species as this species.

The male of this species is similar to that of *P. ondakensis*, but easily distinguishable by the shape of the posterodorsal area of segment VIII and the phallus. The larva of this species is also similar to that of *P. ondakensis* and only distinguishable from that of the latter by the shape of the head dorsally: The head of this species is without a depression along the frontoclypeal suture, but that of *P. ondakensis* has a depression.

***Pseudostenophylax tohokuensis* sp. nov.**

(Figs. 5, 10)

**Diagnosis.** This species belongs to the *P. ondakensis* Species Group (Schmid 1991). The male of this species can be distinguished from those of the other Japanese species by the following unique characters: Intermediate appendages are each shaped as a parallelogram in dorsal aspect, and apices of parameres are round posteriorly and serrate mesally with a few long spines. The larva of this species is similar to those of *P. kuharai* sp. nov. and *P. itoae* sp. nov. in having ventral chloride epithelia on abdominal segments II to VII and a pale marking on the posterior corner of the frontoclypeal apotome of the head, but is distinguishable from these latter species by the length of primary setae no. 5 on their head: Larvae of this species bear short transparent primary setae 5 which are less than half as long as the distance between bases of setae 5, but larvae of the latter 2 species have setae 5 that are longer than the distance between their bases.

**Adult.** Only 2 males and 4 females reared from larvae available for this study. General appearance similar to above 3 species, but ocelli not so large. Forewings 11–13 mm long in male, 10–11 mm in female.

**Male genitalia.** Tergum VIII slightly higher than long in lateral aspect; posterodorsal sclerotized area densely covered by short spine-like setae, similar to that of *P. ondakensis*, but covering slightly greater area posteriorly. Segment IX in lateral aspect short dorsally, concave posteriorly and swelling posterolaterally at midheight. Superior appendages ear-like in lateral aspect, slightly concave mesally. Intermediate appendages each shaped as rounded parallelogram in dorsal aspect; upper side covered with minute denticles, deeply concave; ventral part protruding posteriorly. Lateral sclerites of segment X large, fused into intermediate appendages, protruding posterolaterally. Inferior appendages each one-segmented, triangular in lateral aspect, trapezoidal in ventral aspect. Aedeagus bottle-shaped in dorsal aspect, with long neck and bulbous base; similar to that of *P. dentilus*, but sclerotized base broader than that of *P. dentilus*. Parameres large, membranous basally, sclerotized apically; each having sclerotized area covered with minute denticles apically; apex round posteriorly, serrate mesally, with few long spines.

**Female genitalia.** Very similar to those of *P. dentilus* and indistinguishable from them.

**Final instar larva.** Larva up to 18 mm long. Head mostly reddish brown, but posterior corner of frontoclypeal apotome yellowish brown; round in dorsal aspect; primary setae 5 transparent, short, less than half length of distance between bases of setae 5; setae 6 transparent, short, each slightly shorter than setae 5; setae 14 longest; ventral setae 18 minute. Ventral apotome, labrum and mandibles similar to those of *P. ondakensis*. Prosternal horn long. Pronotal sclerites yellowish to dark brown; with long pigmented or short transparent setae broadly distributed on setal areas from *sa*2 to *sa*3, but setae sparse in anteromesal area; long pigmented setae and short transparent setae arising alternately along anterior margin, anterior edge with transparent hair-like setae. Mesonotal sclerite yellowish to dark brown. Metanotal sclerites yellowish to dark brown, with transverse band of setae between *sa*2 sclerites. Hind femora each with 6 to 7 long setae along ventral edge, with 8 to 15 setae laterally. Abdominal segment I with 60 to 100 setae dorsally, with more than 100 setae ventrally. Abdominal gills single, present on following segments: dorsal gills on abdominal segments II to V (anterior and posterior) and on VI (anterior), and often on VII (anterior); lateral gills on II to IV (anterior and posterior); ventral gills on II to VII (anterior and posterior). Lateral fringe and forked lamellae present on abdominal segments III to VIII. Ventral chloride epithelia present on abdominal segments II to VII. Anal claws each with one accessory hook.

**Case.** Both larval and pupal cases similar to those of *P. tochigiensis*.

**Holotype.** Male (pinned), tributary of Ohtaki-gawa, Kanohara, Kami-cho, Miyagi, 38°32'N, 140°39'E, 450 m a.s.l., larva collected on 6.x.2001, adult emerged on 26.iii.2002 by T. Nozaki (CBM-146872).

**Paratype.** Same data as the holotype except for emergence date of 6.iv.2002, 1 male (in alcohol) (TN).

**Other specimens examined.** Miyagi: Same locality as the holotype, 6.x.2001, T. Nozaki, 4 larvae (TN); same data as the holotype except for emerging date as 26.iii–14.iv.2002, 4 females (1 female: CBM-146880; others: TN).

**Etymology.** Specific name refers to the name of the region where this species was collected.

**Distribution.** Japan (Honshu).

**Biology.** Larvae were collected from a small mountain flow.

**Japanese name.** Tohoku-miyama-tobikera.

***Pseudostenophylax kuharai* sp. nov.**

(Figs. 6, 10)

*Pseudostenophylax* sp.: Ito and Kubo 2011, 9.

*Pseudostenophylax* sp. 2: Kuhara 2011, 53, 74–75

**Diagnosis.** This species belongs to the *P. ondakensis* Species Group (Schmid 1991). Both adults and larvae are very similar to those of *P. itoae* sp. nov., but they are distinguishable from the latter by the following characters. In male genitalia of this species, both intermediate appendages and the dorsal darkly pigmented areas are rounded triangles in dorsal aspect, but intermediate appendages are rectangular and the symmetrical dorsal darkly pigmented areas are normal and reverse L-shaped in *P. itoae*. In the larva of this species, the lengths of primary setae 5 each are more than 1.5 times as long as the distance between the bases of setae 5, but about 1.2 times as long in *P. itoae*.

**Adult.** General appearance similar to *P. tochigiensis*. Forewings 12–17 mm in male, 9–13 mm in female.

**Male genitalia.** Tergum VIII slightly higher than long in lateral aspect; posterodorsal sclerotized area densely covered by short spine-like setae, rounded square in dorsal aspect, with central shallow depression on posterior half. Segment IX in lateral aspect short dorsally, concave posteriorly and swelling posterolaterally at midheight. Superior appendages ear-like in lateral aspect. Intermediate appendages rounded triangular in dorsal aspect, V-shaped in caudal aspect; dark pigmented area rounded triangular in dorsal aspect, covered with minute denticles. Lateral sclerites of segment X largely fused with intermediate appendages. Inferior appendages each one-segmented, triangular in lateral aspect, trapezoidal in ventral aspect, but posterior margin variable. Aedeagus similar to that of *P. dentilus*. Parameres large, membranous basally, sclerotized apically; each having sclerotized part hammer-shaped, covered with minute denticles; mesal part broad, with several long spines apicomesally; outer projection with slightly broader apex, occasionally bent ventrad.

**Female genitalia.** Very similar to those of *P. dentilus*.

**Larva.** Larva up to 20 mm long. Head mostly reddish brown, but posterior corner of frontoclypeal apotome usually pale brown; round in dorsal aspect; primary setae 5 long, each about 1.5 to 1.9 times as long as distance between bases of setae 5; setae 6 transparent, short, each less than 2/5 of seta 5; setae 14 longest; ventral setae 18 minute. Ventral apotome, labrum and mandibles similar to those of *P. ondakensis*. Prosternal horn long. Pronotal sclerites yellowish brown, with long pigmented and shorter semitransparent setae, anterior edge with transparent hair-like setae. Mesonotal sclerites yellowish brown. Metanotal sclerites yellowish brown, with 7–15 setae between *sa2* sclerites. Hind femora each bearing 5–7 setae along ventral edge, with 4–9 setae laterally. Abdominal segment I with 60–90 setae dorsally, with more than 100 setae ventrally. Abdominal gills single, usually present on following segments: Dorsal gills on abdominal segments II to V (anterior and posterior) and on VI to VII (anterior); lateral gills on II to III (anterior and posterior) and IV (anterior); ventral gills on II to VII (anterior and posterior); but arrangement of gills often variable on dorsum of VI and VII, and laterally on II and IV. Lateral fringe present on posterior part of abdominal segment II to VIII. Forked lamellae present on abdominal segments III to VIII. Ventral chloride epithelia present on abdominal segments II to VII. Anal claws each with one accessory hook.

**Case.** Both larval and pupal cases similar to those of *P. tochigiensis*.

**Holotype.** Male (pinned), spring stream beside Peregari-sanso, Sizunai-cho [now Shinhidaka-cho], Hokkaido, 42°29' N, 142°49' E, 400 m a.s.l., larva collected on 23.vii.1995, adult emerged 15.ix.1995 by N. Kuhara (CBM-146873).

**Paratypes.** Same data as the holotype except for emergence date of vi.1996, 1 male (pinned) (NMNH); same data as the holotype except for emergence date of ix.1996, 1 male (in alcohol) (TN).

**Other specimens examined. Hokkaido:** Satsunai-dam, Nakasatsunai-mura, 16.vi.1998 (light), M. Ishizuka, 1 male (TN); Kamisatsunai-bashi, Nakasatsunai-mura, 22.vii.2003, Hokkaisuiko, 1 male (TN); small stream, 380 m a.s.l., Futamata, Kamitoyoni, Hiroo-cho, 9.v.2010, T. Ito, 2 larvae (NMNH); ibid., 19.vi.2010, T. Ito, 5 males (TN); spring stream, near Hodaka-bashi, Shimukappu-mura, 29.iv.–5.v.2009 (Malaise trap), N. Kuhara, 14 males, 1 female (TN); small stream, Akaiwa, Shimukappu-mura, 5–15.v.2009 (Malaise trap), N. Kuhara, 6 males (TN); small stream, Kanayama-toge, Shimukappu-mura, 5–15.v.2009 (Malaise trap), N. Kuhara, 2 males (TN); Chubetsu-dake, 1,650 m a.s.l., Taisetsu-zan, 28.vii–3.viii.1975, M. Suwa et al., 1 male (TN); same locality as holotype, larvae collected on 23.vii.1995, fixed during vi–xi.1996 by N. Kuhara, 2 males, 9 larvae (TN); ibid.,

larvae collected on 23.vii.1995, adults emerged vii.1996 by N. Kuhara, 2 females (1 female CBM; 1 female TN); Yubari-dake, 26.vii.1977, T. Hattori, 1 male (TN); Poroshiri-dake, Hidaka Ms., 24.vi.1975, T. Hattori, 1 larva (TN); Yufure-zawa, Ashibetsu-dake, 3.vii.1976, T. Hattori, 4 larvae (TN); R. Penkemoyuuparo, 650 m a.s.l., Yubari-shi, Hokkaido, 4.vii.1991, N. Kuhara, 2 males (TN); Ikutora-toge, 650 m a.s.l., Minamifurano-cho, 23.v–9.vi.2009 (Malaise trap), N. Kuhara, 30 males, 7 females (TN); small stream, Karikachi-toge, 5–15.v.2009 (Malaise trap), N. Kuhara, 1 male (TN); Shizunai, Shinhidaka-cho, 6.vi.1992, T. Ito, 1 male (TN); small stream near Hidaka tunnel, Hidaka-cho, 5.v.1996, N. Kuhara, 1 male (TN); tributary of Rokuno-sawa, Pankenushi-gawa, Hidaka-cho, 8.viii.2008, N. Kuhara, 1 male (TN); Niikappu-dam, 400–600 m a.s.l., Niikappu-cho, 4.xi.1982, T. Ito, 7 larvae (TN); small stream near Iwashimizu-hendensho, Niikappu-cho, 8.ix.1995, T. Kishimoto, 1 larva (TN); spring, Izumi, Niikappu-cho, 19–25.iv.2009 (Malaise trap), N. Kuhara, 3 males (TN); Nissho-toge, head water of Sarugawa, Hidaka-cho, 25.viii–5.ix.2009 (Malaise trap), N. Kuhara, 12 males, 6 females (TN); small stream, Meguro, Erimo-cho, 11–25.iv.2010 (Malaise trap), N. Kuhara, 7 males, 1 female (TN).

**Etymology.** This species is dedicated to Dr. Naotoshi Kuhara, Chitose Board of Education, who gifted me many valuable specimens, including this species.

**Distribution.** Japan (Hokkaido).

**Biology.** Larvae were collected from small mountain streams. Adults were collected from early summer to autumn (Kuhara 2011).

**Japanese name.** Kuhara-miyama-tobikera.

***Pseudostenophylax itoae* sp. nov.**

(Figs. 7, 10)

*Pseudostenophylax* sp. 1: Kuhara 2011, 53, 74.

**Diagnosis.** This species belongs to the *P. ondakensis* Species Group (Schmid 1991). Both adults and larvae are very similar to those of *P. kuharai* sp. nov., but are distinguishable from the those of the latter by the characters given in the diagnosis for that species.

**Adult.** General appearance similar to *P. ondakensis*. Forewings 13–16 mm long in male, 9–11 mm in female.

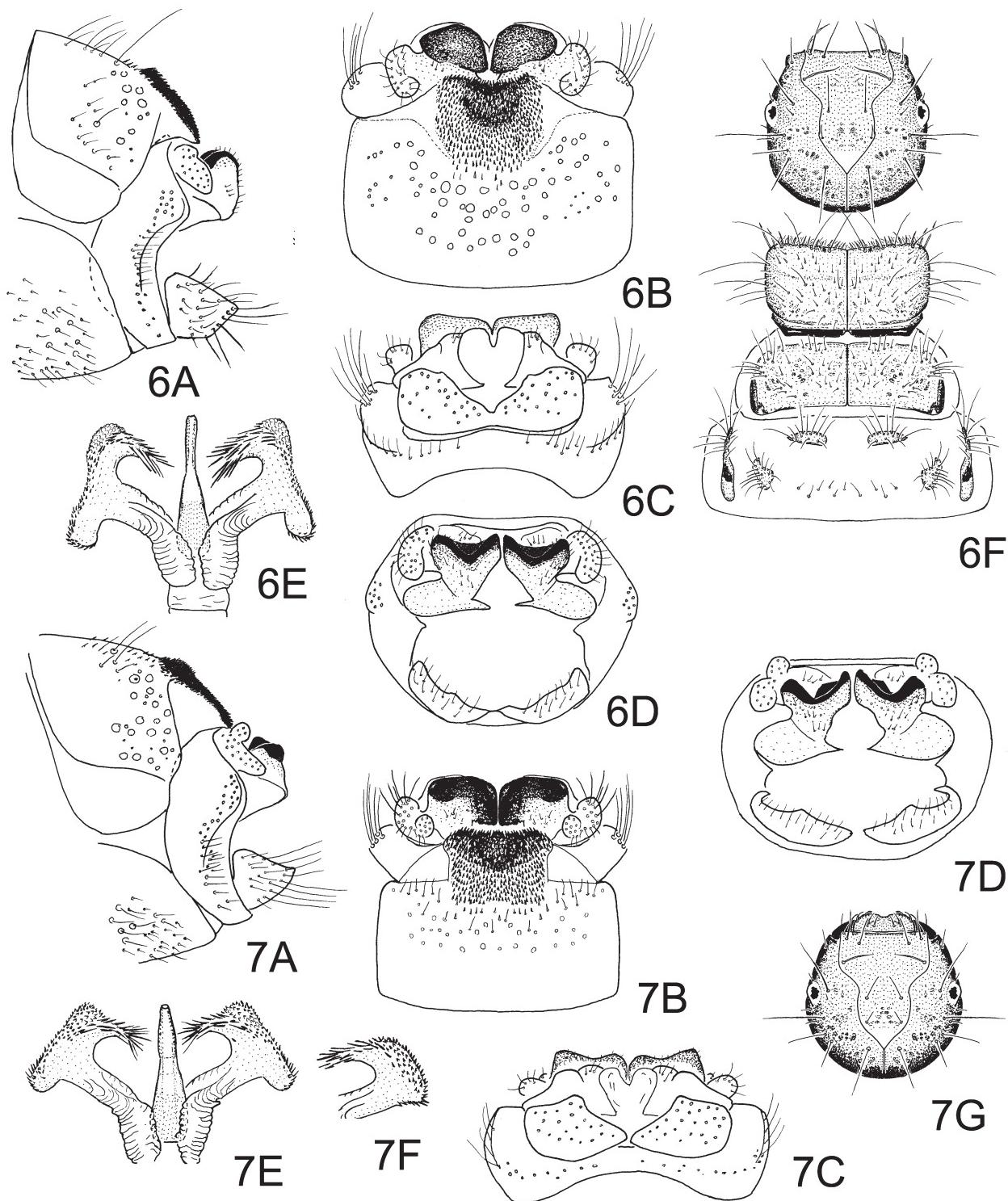
**Male genitalia.** Tergum VIII higher than long in lateral aspect; posterodorsal sclerotized area densely covered by short spine-like setae, rounded square with slightly wider posterior margin in dorsal aspect, with central depression on posterior half. Segment IX in lateral aspect short dorsally, concave posteriorly and swelling posterolaterally at midheight. Superior appendages with dorsal globular lobe in lateral aspect. Intermediate appendages rectangular in dorsal aspect, slightly longer than wide, V-shaped in caudal aspect; symmetrical dark pigmented areas normal and reverse L-shaped in dorsal aspect, covered with minute denticles. Lateral sclerites of segment X largely fused with intermediate appendages. Inferior appendages each one-segmented, triangular in lateral aspect; trapezoidal in ventral aspect, but posterior margin variable. Phallicata bottle-shaped in dorsal aspect, with long neck and bulbous base; mostly sclerotized. Parameres similar to those of *P. kuharai*, but both projections shorter than those of latter, occasionally hook-like, covered with minute denticles; each with mesal part broader, with several long spines apicomesally.

**Female genitalia.** Very similar to those of *P. dentilus*.

**Final instar larva.** Larva up to 19 mm long. Head mostly reddish brown, but posterior corner of frontoclypeal apotome yellowish brown; round in dorsal aspect; primary setae 5 relatively long, each about 1.2 times distance between bases of setae 5; setae 6 transparent, short, each about half length of seta 5; setae 14 longest; ventral setae 18 minute. Ventral apotome, labrum and mandibles similar to those of *P. ondakensis*. Prosternal horn long. Pronotal sclerites yellowish brown, bearing long pigmented and short semitransparent setae; anterior edge with transparent hair-like setae. Mesonotal sclerites yellowish brown. Metanotal sclerites yellowish brown, with 7–12 setae between *sa2* sclerites. Hind femora each bearing 5–7 setae along ventral edge, with 6–9 setae laterally. Abdominal segment I with 60 to 80 setae dorsally, with more than 100 setae ventrally. Abdominal gills single, present on following segments: Dorsal gills on abdominal segments II to III (anterior and posterior), on IV (anterior and often posterior), on V (anterior) and often on VI (anterior); lateral gills on II (posterior) and on III (anterior and posterior); ventral gills on II to VII (anterior and posterior). Lateral fringe present on posterior part of abdominal segment II to VIII.

Forked lamellae present on abdominal segments III to VIII. Ventral chloride epithelia present on abdominal segments II to VII. Anal claws each with one accessory hook.

**Case.** Both larval and pupal cases similar to those of *P. tochigiensis*.



**FIGURES 6–7. 6, Male and larva of *Pseudostenophylax kuharai*. A–E, male genitalia: A, left lateral; B, dorsal; C, ventral; D, caudal; E, phallus, dorsal. F, larval head, pro-, meso- and metanota, dorsal. 7, Male and larva of *P. itoae*. A–F, male genitalia: A, left lateral; B, dorsal; C, ventral; D, caudal; E, phallus, dorsal; F, apex of left paramere, variation, dorsal. G, larval head, dorsal.**

**Holotype.** Male (pinned), head waters, Izari-gawa, Eniwa-shi, Ishikari, Hokkaido, 42°48'54"N, 141°16'4.8"E, 23.viii.2009, N. Kuhara (light) (CBM-146874).

**Paratypes.** Izari-gawa, 205 m a. sl., Eniwa-shi, Ishikari, Hokkaido (42°51'29"N, 141°23'21"), 21.viii.2008, T. Ito (light), 3 males (in alcohol) (2 males: NMNH, 1 male: TN).

**Other specimens examined.** Hokkaido: Rarumanai-gawa, 700 m a.s.l., Eniwa-shi, 11–21.viii.2004 (Malaise trap), T. Ito, 4 males, 1 females (TN); a tributary of Rarumanai-gawa, 700 m a.s.l., Eniwa-shi, 13.vii.2002, T. Ito, 4 larvae (TN); ibid., larvae collected on 13.vii.2002, adults emerged on 23–29.viii.2002 by T. Ito, 3 females (TN); Otarunai R., 450 m a.s.l., Sapporo-shi, 17.vi.1992 (light), N. Kuhara, 1 male (TN); small stream, 450 m a.s.l., Bifue, Chitose-shi, 17.v–5.ix.2009 (Malaise trap), N. Kuhara, 17 males, 1 female (TN); small stream, Bifue-notaki, Bifue-gawa, Chitose-shi, 27.viii.2001, T. Ito, 1 larva (TN); small stream, Orofure-toge, 810 m a.s.l., Sobetsu-cho, 11–25.vi.2011 (Malaise trap), N. Kuhara, 3 males (TN); spring stream beside Shiribetsu-gawa, Aichi, Otaki-ku, Date-shi, 11–25.vi.2011 (Malaise trap), N. Kuhara, 5 males (TN).

**Etymology.** This species is dedicated to Dr. Tomiko Ito, Hokakido Aquatic Biology, who gifted me many valuable specimens, including this species.

**Distribution.** Japan (Hokkaido).

**Biology.** Larvae were collected from small mountain streams. Adults were collected from early summer to autumn (Kuhara 2011).

**Japanese name.** Ito-miyama-tobikera.

#### *Pseudostenophylax tanidai* sp. nov.

(Figs. 8, 10)

*Pseudostenophylax* sp.: Tanida 1990, 54, 56.

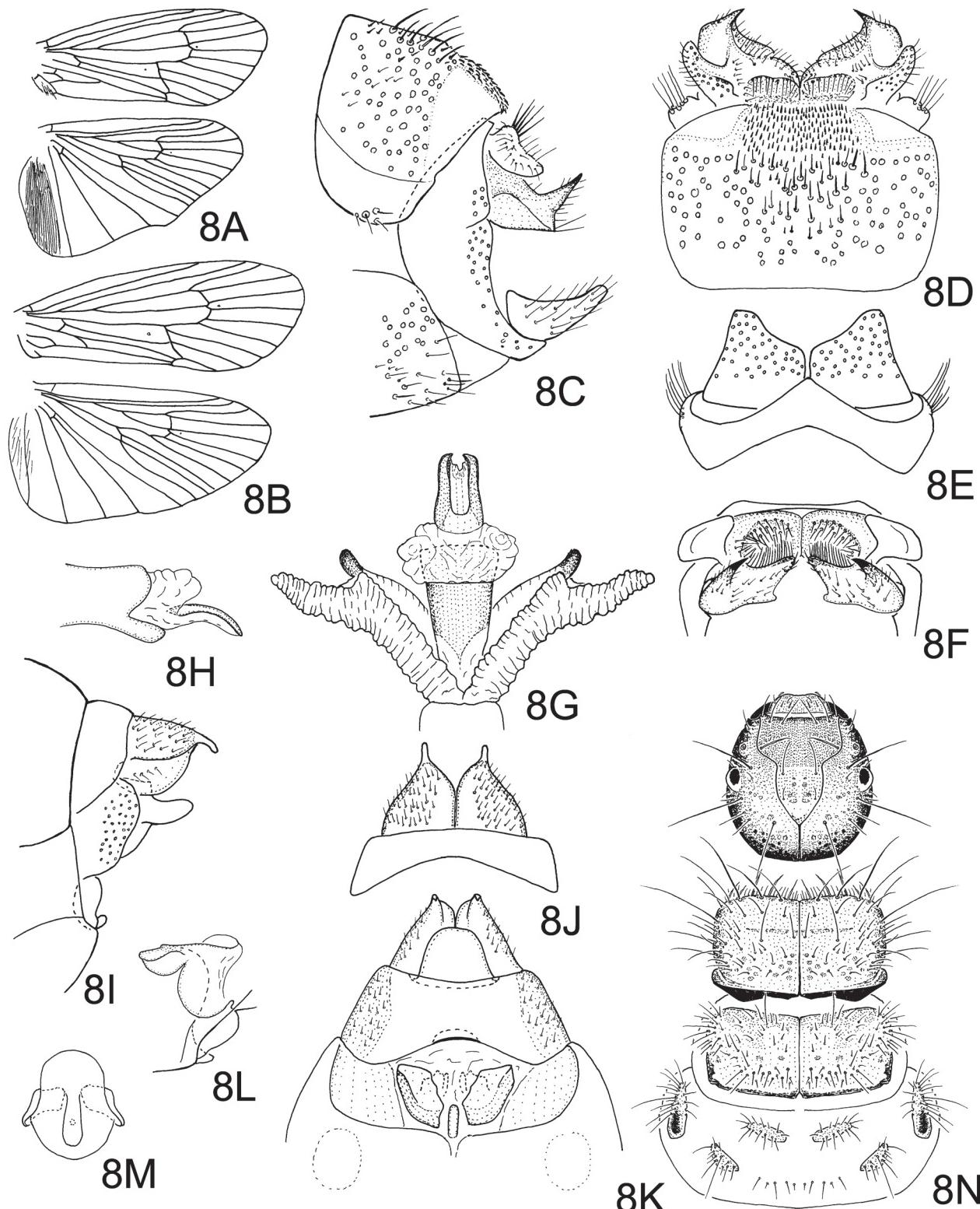
**Diagnosis.** This species belongs to *P. adlimitans* Species Group (Schmid 1991). This species and *P. befui* sp. nov. are closely related to each other in the shape of male and female genitalia, but is easily distinguishable from the latter by the male genitalia: Phallicata with long forceps-like phallotremal sclerite apically, but with shorter phallotremal sclerite in *P. befui*; and parameres each bearing short finger-like sclerotized process, but parameres entirely membranous in *P. befui*.

Furthermore, adults are easily distinguishable from those of Japanese species belonging to the *P. ondakensis* Species Group by the following characters. In the male of this species, the hind wings are wider than the forewings, but they are approximately the same width as the forewings in the *P. ondakensis* Species Group; the jugal regions of the hindwings bear many long white hair-like setae, but these setae are not so dense in the *P. ondakensis* Species Group; the parameres each consist of a small sclerotized lobe and a large membranous lobe, but they are not divided in the *P. ondakensis* Species Group. In female genitalia of this species, segment X has a large bulge under the anal opening, but segment X is without this bulge in the *P. ondakensis* Group. Larvae of this species are similar to those of *P. tochigiensis* in having ventral chloride epithelium on abdominal segment VIII, but can be distinguished from the latter by the length of primary setae 5 on the head: The length of each seta 5 is about 2 times as long as the distance between the bases of setae 5 in this species, but less than 1.5 times as long in *P. tochigiensis*.

**Adult.** General appearance similar to that of species in *P. ondakensis* Species Group, but color of forewings darker. Forewings 12–15 mm long in male, 13–18 mm in female (i.e., generally longer in females than in males). Hind wings pale brown, wider than forewings, anal area highly developed in male; jugal region thickly covered with white hair-like bristles in male, hair-like setae short and sparse in female. Venation as in Figures 8A, 8B. Tibial spurs 1-3-4.

**Male genitalia.** Tergum VIII with posterodorsal sclerotized area covered by many short spine-like setae. Segment IX in lateral aspect short dorsally, concave posteriorly and swelling posterolaterally at midheight. Superior appendages ear-like in lateral aspect. Segment X with pair of nostril-like concavities dorsally, inner surface with many long setae. Intermediate appendages beak-like in dorsal aspect, acute apices directed dorsomesad. Lateral sclerites of segment X largely fused with intermediate appendages. Inferior appendages each one-segmented, long triangular in lateral aspect, trapezoidal in ventral aspect. Phallicata and endophallic membranes thick, phallotremal sclerite strongly sclerotized dorsolaterally, forceps-like in dorsal aspect; phallicata

cylindrical, with spatula-shaped projection posteroventrally, strongly sclerotized. Parameres large, mostly membranous, each divided into two parts; mesal sclerotized projection darkly pigmented, with minute denticles apically; lateral membrane long, tapering.



**FIGURE 8. Adults and larva of *Pseudostenophylax tanidai*.** A, right male wings, dorsal. B, right female wings, dorsal. C–H, male genitalia: C, left lateral; D, dorsal; E, ventral; F, caudal; G, phallus, dorsal; H, phallicata, endophallic membranes and phallotremal sclerite, left lateral. I–M, female genitalia: I, left lateral; J, dorsal; K, ventral; L, vaginal sclerite, left lateral; M, vaginal sclerite, dorsal. N, larval head, pro-, meso- and metanota, dorsal.

**Female genitalia.** Tergum IX rectangular in lateral aspect. Sternum IX semicircular in lateral aspect. Segment X developed into two lobes, each bell-shaped in dorsal aspect, as long as basal width in dorsal aspect; with slender finger-like process apically, apices slightly curved ventrad, unpigmented; with large bulge under anal opening, weakly sclerotized. Supragenital plate rudimentary. Vulval scale consisting of median lobe and pair of lateral lobes; median lobe slender oval in lateral aspect, directed posterad; lateral lobes elliptical in ventral aspect, caudal surface slightly concave. Vaginal sclerite situated posteriorly, reverse L-shaped in lateral aspect, oval in dorsal aspect.

**Final instar larva.** Larva up to 18 mm long. Head round in dorsal aspect; mostly reddish to dark brown, but often paler posterodorsally, especially in posterior corner of frontoclypeal apotome; primary setae 5 long, each about 2 times as long as distance between bases of setae 5; setae 6 transparent, short, each about 1/3 length of seta 5; setae 14 longest; ventral setae 18 minute. Ventral apotome vase-shaped, elongate caudally. Labrum yellowish brown; with primary setae 2–6 on dorsum; anteroventral setae 1 shortest. Mandibles black; right and left ones almost symmetrical, triangular in dorsal aspect; four apical teeth present, often shortened or indistinct by abrasion. Prosternal horn long. Pronotal sclerites yellowish brown, with long pigmented and short transparent setae; anterior edge with transparent hair-like setae. Mesonotal sclerites yellowish brown. Metanotal sclerites yellowish brown, with about 10 setae between *sa*2 sclerites. Hind femora each bearing 4 to 6 setae along ventral edge, lateral side with 3 to 5 setae near ventral margin. Abdominal segment I with about 100 setae dorsally, with more than 100 setae ventrally. Abdominal gills single, usually present on following segments: Dorsal gills on abdominal segments II to VI (anterior and posterior), and on VII (anterior); lateral gills on II to IV (anterior and posterior); ventral gills on II to VII (anterior and posterior); but arrangement of gills on dorsum of VI and VII variable. Lateral fringe present on abdominal segments III to VIII. Forked lamellae present on abdominal segments III to VIII. Ventral chloride epithelia present on abdominal segments II to VIII. Anal claws each with one accessory hook.

**Case.** Larval case similar to that of *P. tochigiensis*.

**Holotype.** Male (pinned), Kurotaki-bashi, Oyacho-yokoiki, Yabu-shi, Hyogo, 35°20'16.7"N, 134°30'53.7"E, 1,240 m a.s.l., 17.ix.1988, C. Kugo (CBM-146875).

**Paratype.** Same data as the holotype, 1 male (in alcohol) (TN).

**Other specimens examined.** **Hyogo:** Same data as the holotype, 4 females (1 female CBM-146881; others TN); same data as the holotype except for collecting date 28.viii.1990, 1 male, 1 female (KT); Shindai-goya, Hyono-sen, 25.v.1988, K. Tanida, 30 larvae (KT); near the top of Hyono-sen, Yabu-shi, 14.x.1969, N. Nishimura, 3 larvae (TN); **Tottori:** Dai-sen, 14.x.2001, T. Befu, 1 male (TN); **Ehime:** Banjo-dani, Wakayama, Kumakogen-cho, 19.vii.2003, M. Takai, 1 male (TN); Heitsubo, ca. 1,660 m a.s.l.; Heiga-mori, Saijo-shi, 26.v.2012, M. Takai, 2 larvae (TN); ibid., 2.vi.2012, M. Takai, 21 larvae (2 larvae NMNH; others TN); **Kochi:** Heiga-mori, Terakawa, Ino-cho, 10.vii.1993, T. Befu, 2 males (TN); ibid., 13.vii.2002, T. Befu, 1 male (TN); ibid., 1.viii.2003 (light), T. Befu, 1 male, 2 females (TN); Sangaku-doro, Terakawa, Ino-cho, 12.vii.2002, M. Takai, 2 males, 1 female (TN); near Nishiguro-mori, Terakawa, Ino-cho, 1.viii.2003 (light), M. Takai, 15 males, 2 female (TN); ibid., 30.vii.2005, M. Takai, 10 males, 4 females (TN); Higashikuromori-yama, Terakawa, Ino-cho, 1.viii.2006 (light), M. Takai, 3 females (TN); **Kumamoto:** Siiya-toge, Yamato-cho, 13.vii.1988, I. Ohtsuka, 1 male, 1 female (KT).

**Etymology.** This species is dedicated to Professor Kazumi Tanida, Osaka Prefecture University, who mentioned this species as an undescribed species for the first time.

**Distribution.** Japan (Honshu, Shikoku, Kyushu).

**Biology.** Larvae were collected from headwaters in high mountain areas. Both males and females were collected by light traps in summer.

**Japanese name.** Tanida-miyama-tobikera.

### *Pseudostenophylax befui* sp. nov.

(Figs. 9, 10)

**Diagnosis.** This species belongs to the *P. adlimitans* Species Group (Schmid 1991) although the male has entirely membranous parameres. This species can be distinguished from a closely related species, *P. tanidai* sp. nov., by the differences in the male genitalia given in the diagnosis for that species.

**Adult.** General appearance very similar to *P. tanidai*. Forewings 14–16 mm long in male, 16–17 mm in female.

**Male genitalia.** Tergum VIII with posterodorsal sclerotized area covered by many short spine-like setae.

Segment IX in lateral aspect short dorsally, straight posteriorly and swelling posterolaterally at midheight. Superior appendages long oval in lateral aspect. Segment X with pair of nostril-like concavities dorsally, inner surface with many long setae. Intermediate appendages beak-like in dorsal aspect, acute apices directed dorsomesad. Lateral sclerites of segment X largely fused with intermediate appendages. Inferior appendages each one-segmented, long triangular in lateral aspect, trapezoidal in ventral aspect. Phallicata and endophallic membranes thick; with short fork-like phallotremal sclerite dorsally; phallicata short, cylindrical, weakly sclerotized. Parameres large, entirely membranous.

**Female genitalia.** Very similar to those of *P. tanidai* and indistinguishable from each other.

**Immature stages.** Unknown.

**Holotype.** Male (pinned), Minokoshi, Higashiiya-sugeoi, Miyoshi-shi, Tokushima, 33°52'N, 134°5'E, 1,350 m a.s.l., 20.vii.2001, T. Befu (CBM-146876).

**Paratypes.** Same data as holotype except collecting date 26.viii.1995, 1 male (pinned) (NMNH); Nishikumamoto, Monobe-cho, Kami-shi, 28.vii.2001, M. Takai, 1 male (in alcohol) (TN).

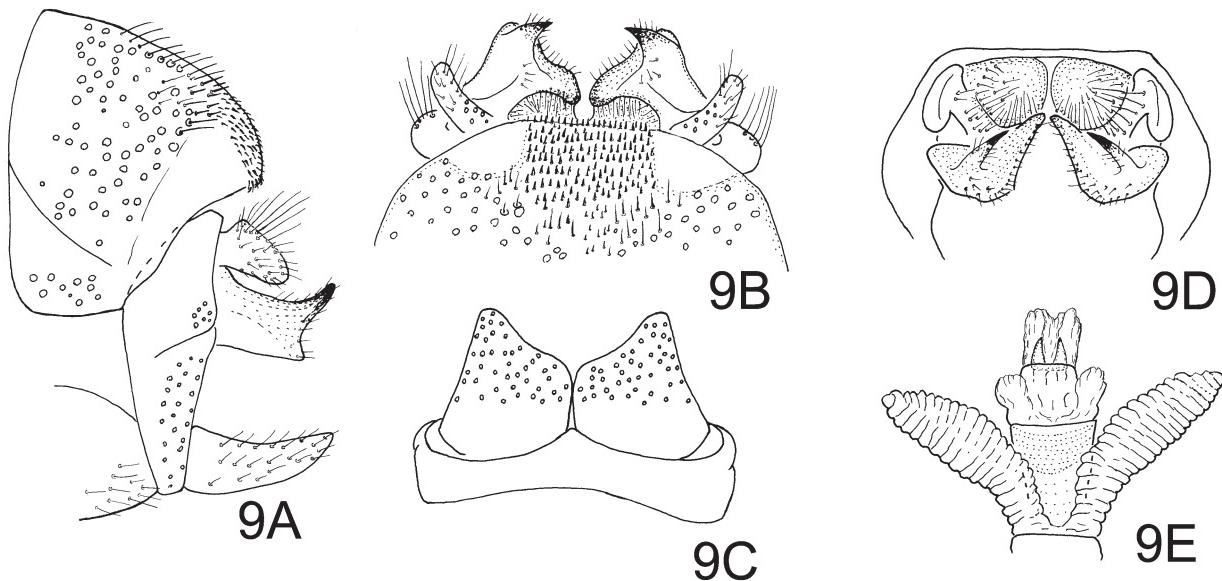
**Specimens examined.** **Mie:** Nishinotani, 1,200 m a.s.l., Osugi, Odai-cho, 3.vi.2001, T. Mano, 1 male (TN); Odaigahara, Odai-cho, 3.viii.2004, H. Ichihashi, 1 male (TN); **Nara:** Odaigahara, 14.vii.1983, F. Kimura, 5 males, 2 females (TN); **Tokushima:** Same data as holotype except collecting date 26.viii.1995, 1 female (NMNH); same data as the holotype, except collecting date 8.viii.1998, 1 female (CBM-146882); **Kochi:** Shiraga-goe, Monobe-cho, Kami-shi, 24.vii.2004, M. Takai, 1 male (TN).

**Etymology.** This species is dedicated to Mr. Takamori Befu, who gifted me valuable specimens, including this species.

**Distribution.** Japan (Honshu, Shikoku).

**Biology.** Adult males and females were collected by light traps near headwaters in mountain areas.

**Japanese name.** Befu-miyama-tobikera.

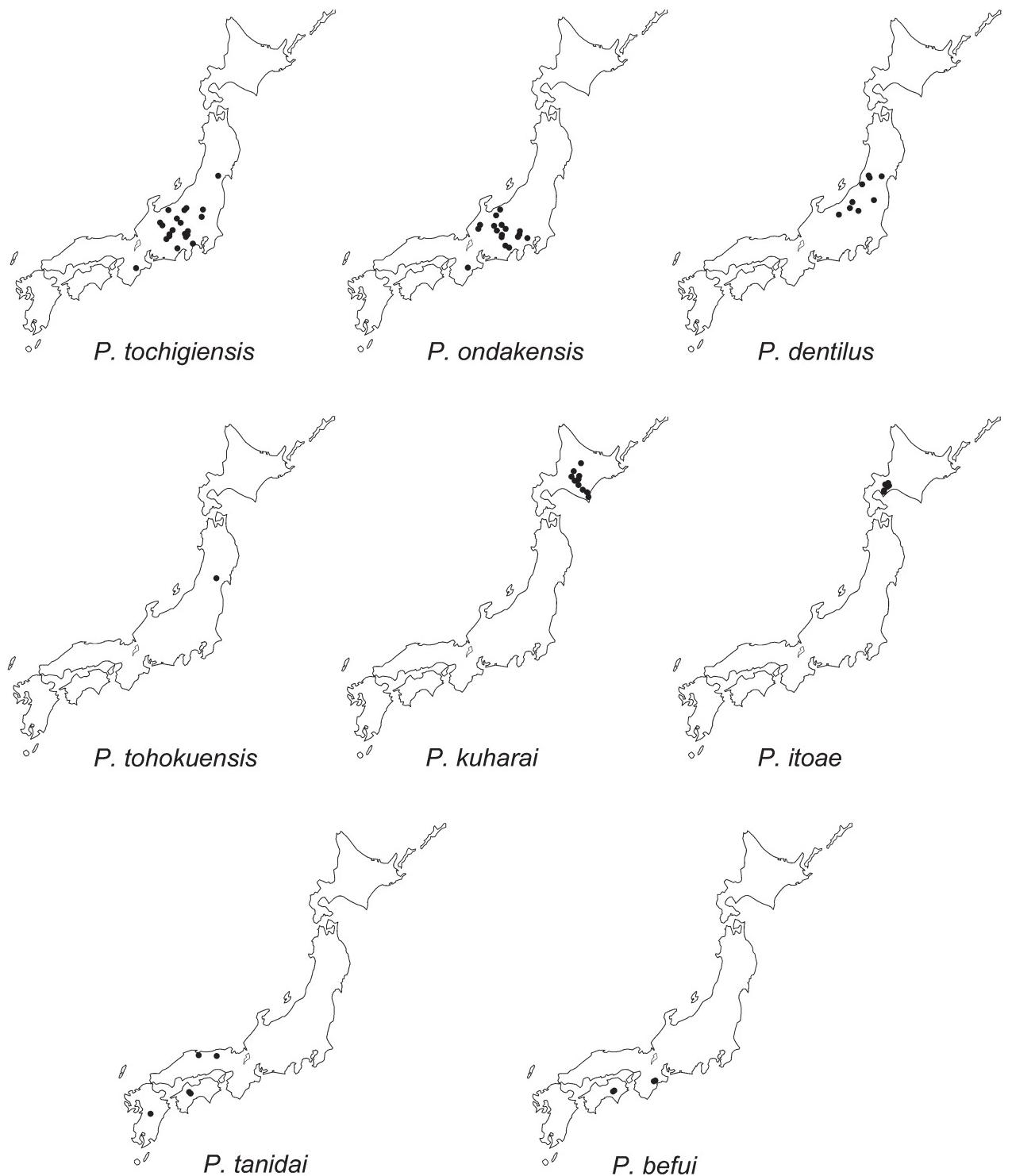


**FIGURE 9.** Male of *Pseudostenophylax befui*. A–E, male genitalia: A, left lateral; B, dorsal; C, ventral; D, caudal; E, phallus, dorsal.

#### Insertae sedis

#### *Pseudostenophylax imanishii* (Iwata 1928), Comb. nov.

*Drusus imanishii* Iwata 1928, 122–123, 127, 130, larva, case.



**FIGURE 10.** Distributions of Japanese *Pseudostenophylax* species.

**Specimens examined.** Type series of *Drusus imanishi*: 13 larvae, Sugoroku-dani, 1,880 m a.s.l., Gifu, VIII.1927, Imanishi (KUM).

**Remarks.** Iwata (1928) described this species as a member of the European genus *Drusus* Stephens. The type series specimens of this species deposited in the collection of KUM are early instar larvae, and not in good condition, being dried up. However, general morphology, especially setation on the head, thorax and legs of these

larvae is very similar to that of 2nd or 3rd instar larvae of Japanese *Pseudostenophylax* examined in this study. Although I could not identify the specimens to the species level, this species must belong to the genus *Pseudostenophylax*. No adult of the subfamily Drusinae has been collected from East Asia. The type locality of this species is in the ranges of *P. tochigiensis* and *P. ondakensis*.

## Acknowledgements

I express my cordial thanks to O.S. Flint, Jr., National Museum of Natural History, Smithsonian Institution, T. Kakutani, the Kyoto University Museum, and R.B. Kuranishi, Natural History Museum and Institute, Chiba, for providing me the opportunity to examine type series specimens used in this study. For the loan or the gift of valuable materials, or/and guidance for field collections, I am grateful to the following persons: T. Befu, Kochi-shi; T. Hattori, Shizuoka-shi; S. Ishiwata, Yokohama-shi; T. Ito, Hokkaido Aquatic Biology; T. Kagaya, The University of Tokyo; N. Kawase, Minakuchi Kodomo-no-mori Nature Museum; T. Kishimoto, Tsukuba International University; C. Kugo, Kamikawa-cho; N. Kuhara, Chitose Board of Education; H. Morita, Yokkaichi-shi; H. Moriya, Sagamihara City Museum; J. Nakase, Sendai-shi; K. Nio, Kochi-shi; H. Nishimoto, Komak-shi; N. Nishimura, Yabu-shi; N. Nishio, Ueda-shi; M. Takai, Konan-shi; K. Tanida, Osaka Prefecture University; T. Tsuruishi, Ramkhamhaeng University.

## References

- Ito, T. & Kubo, E. (2011) Caddisfly (Trichoptera) fauna of Toyoni-gawa River system, Tokachi, Hokkaido, northern Japan. *Sylvicola*, 29, 1–12. [in Japanese with English abstract]
- Iwata, M. (1928) Trichopterous larvae from Japan (II). *Zoological Magazine*, 40, 115–130. [in Japanese with English descriptions of the species]
- Iwata, M. (1930) Ondake-tobikera youchu ni tsuite [On the larvae of *Pseudostenophylax ondakensis*]. In: Tanaka, A. (Ed.), *Nihon Kita-alps kosho no kenkyu*, Kokonshoin, pp. 1022–1027. [in Japanese]
- Kobayashi, M. (1973) Caddisfly fauna of the vicinity of Yamagata Prefecture, with descriptions of thirteen new species. *Bulletin of the Kanagawa Prefectural Museum (Natural Science)*, 6, 21–44 + pls. 1–10.
- Kuhara, N. (2011) Species compositions and flight periods of caddisflies (Trichoptera) at headwater streams in Hokkaidō, northern Japan. *Biology of Inland Waters*, 26, 47–76. [in Japanese with English abstract]
- Martynov, A.V. (1909) Les Trichoptères du Tibet oriental et du Tsaidam, d'après les matériaux collectionnés par l'expédition de la Société impériale de géographie de Russie, sous la direction de P.K. Koslov. *Annuaire du Musée Zoologique Académie Impériale des Sciences de Pétrrogard*, 14, 256–309.
- Morse, J.C. (Ed.) (2013) Trichoptera World Checklist. Available from: <http://entweb.clemson.edu/database/trichopt/index.htm> (Accessed 8 January 2013)
- Nozaki, T., Tanida, K. & Ito, T. (2000) Checklists of Trichoptera in Japan 4. Goeridae, Uenoidae and Limnephilidae. *Limnology*, 1, 197–208.  
<http://dx.doi.org/10.1007/s102010070007>
- Schmid, F. (1955) Contributions à l'étude des Limnophilidae (Trichoptera). *Mitteilungen der Schweizerischen Entomologischen Gesellschaft*, 28, 1–245.
- Schmid, F. (1991) La sous-famille des Pseudosténophylacines (Trichoptera, Limnephilidae). *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Entomologie*, 61, supplement, 3–68 + pls. 1–13.
- Schmid, F. (1998) *The insects and Arachnids of Canada. Part 7. Genera of the Trichoptera of Canada and adjoining or adjacent United States*. NRC Research Press, Ottawa, 319 pp.
- Tanida, K. (1985) Trichoptera. In: Kawai, T. (Ed.), *An illustrated Book of Aquatic Insects of Japan*, Tokai University Press, Tokyo, pp. 167–215. [in Japanese]
- Tanida, K. (1990) Trichoptera fauna in streams near Mt. Hyonosen, Hyogo Prefecture (A preliminary report). *Hyogo Fresh-Water Biology*, 36/37, 53–58. [in Japanese]
- Tsuda, M. (1945) On *Stenophylax ondakensis* Iwata (Trichoptera). *Mushi*, 16, 11–14. [in Japanese]
- Tsuda, M. (1959) Trichoptera. In: Esaki, T. et al. (Eds.), *Illustrated insect larvae of Japan*, Hokuryukan, Tokyo, pp. 126–153. [in Japanese]
- Wiggins, G.B. (1996) *Larvae of the North American Caddisfly Genera (Trichoptera)*, 2nd ed. University of Toronto Press, Toronto, Buffalo, London, 457 pp. [Figure legends]